

FORM PTO-1350 (REV. 11-2000)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				3552-0107P	
				U.S. APPLICATION NO. (If known, see 37 CFR 1.5) <b>09/831449</b>	
INTERNATIONAL APPLICATION NO. PCT/EP99/09173		INTERNATIONAL FILING DATE November 23, 1999		PRIORITY DATE CLAIMED November 28, 1998	
TITLE OF INVENTION STERILISER					
APPLICANT(S) FOR DO/EO/US James LUCAS, James Lodovico MORUZZI					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
1.	<input checked="" type="checkbox"/>	This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.			
2.	<input type="checkbox"/>	This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.			
3.	<input checked="" type="checkbox"/>	This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39 (1).			
4.	<input type="checkbox"/>	The US has been elected by the expiration of 19 months from the priority date (Article 31).			
5.	<input checked="" type="checkbox"/>	A copy of the International Application as filed (35 U.S.C. 371(c)(2))			
	<input checked="" type="checkbox"/>	is transmitted herewith (required only if not transmitted by the International Bureau).			
	<input checked="" type="checkbox"/>	has been transmitted by the International Bureau. WO 00/32244			
	<input type="checkbox"/>	is not required, as the application was filed in the United States Receiving Office (RO/US).			
6.	<input type="checkbox"/>	An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).			
	<input type="checkbox"/>	is transmitted herewith.			
	<input type="checkbox"/>	has been previously submitted under 35 U.S.C. 154(d)(4)			
7.	<input checked="" type="checkbox"/>	Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).			
	<input checked="" type="checkbox"/>	are transmitted herewith (required only if not transmitted by the International Bureau).			
	<input type="checkbox"/>	have been transmitted by the International Bureau.			
	<input type="checkbox"/>	have not been made; however, the time limit for making such amendments has NOT expired.			
	<input type="checkbox"/>	have not been made and will not be made.			
8.	<input type="checkbox"/>	An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).			
9.	<input type="checkbox"/>	An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).			
10.	<input type="checkbox"/>	An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).			
Items 11. to 20. below concern document(s) or information included:					
11.	<input checked="" type="checkbox"/>	An Information Disclosure Statement under 37 CFR 1.97 and 1.98/International Search Report with cited references			
12.	<input type="checkbox"/>	An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.			
13.	<input checked="" type="checkbox"/>	A FIRST preliminary amendment.			
14.	<input type="checkbox"/>	A SECOND or SUBSEQUENT preliminary amendment.			
15.	<input type="checkbox"/>	A substitute specification.			
16.	<input type="checkbox"/>	A change of power of attorney and/or address letter.			
17.	<input type="checkbox"/>	A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821-1.825.			
18.	<input type="checkbox"/>	A second copy of the published international application under 35 U.S.C. 154(d)(4).			
19.	<input type="checkbox"/>	A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).			
20.	<input checked="" type="checkbox"/>	Other items or information: PCT/IPEA/409 PCT/IPEA/416 PCT/IB/308			

U.S. APPLICATION NUMBER (37 CFR 1.51) <div style="font-size: 2em; font-weight: bold; margin-left: 100px;">097831449</div>		INTERNATIONAL APPLICATION NO. PCT/EP99/0973		ATTORNEY'S DOCKET NUMBER 3552-0107P							
21. <input checked="" type="checkbox"/> The following fees are submitted: <b>BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5):</b> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO. .... \$1,000.00  International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... \$860.00  International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO. .... \$710.00  International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$690.00  International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00 <b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>				<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left;">CALCULATIONS</th> <th style="text-align: left;">PTO USE ONLY</th> </tr> <tr> <td style="height: 150px; vertical-align: bottom;"> <b>\$ 860.00</b> </td> <td></td> </tr> <tr> <td style="height: 30px; vertical-align: bottom;"> <b>\$ 130.00</b> </td> <td></td> </tr> </table>		CALCULATIONS	PTO USE ONLY	<b>\$ 860.00</b>		<b>\$ 130.00</b>	
CALCULATIONS	PTO USE ONLY										
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Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: right;">\$</td> <td style="width: 50%; text-align: left;">130.00</td> </tr> </table>		\$	130.00				
\$	130.00										
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE								
Total Claims	36 - 20 =	16	X \$18.00	\$	288.00						
Independent Claims	6 - 3 =	3	X \$80.00	\$	240.00						
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ \$270.00	\$						
<b>TOTAL OF ABOVE CALCULATIONS =</b>				\$	1518.00						
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				\$	759.00						
<b>SUBTOTAL =</b>				\$	759.00						
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$							
<b>TOTAL NATIONAL FEE =</b>				\$	759.00						
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				\$							
<b>TOTAL FEES ENCLOSED =</b>				\$	759.00						
				Amount to be:	\$						
				refunded	\$						
				charged	\$						
a. <input checked="" type="checkbox"/> A check in the amount of \$ <b>759.00</b> to cover the above fees is enclosed.  b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.  c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>02-2448</u> .  <b>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</b>  Send all correspondence to: <b>Birch, Stewart, Kolasch &amp; Birch, LLP</b> or Customer No. 2292 P.O. Box 747 Falls Church, VA 22040-0747 (703)205-8000  Date: <u>May 10, 2001</u>											
				By <u>Joe McKinney Muncy</u> Joe McKinney Muncy, #32,334							

09/83144 9  
JC08 Rec'd PCT/PTO 10 MAY 2001

PATENT  
3552-0107P

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: LUCAS, James et al.  
Appl. No.: NEW  
Filed: May 10, 2001  
For: STERILISER

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents  
Washington, DC 20231

May 10, 2001

Sir:

The following preliminary amendments and remarks are respectfully submitted in connection with the above-identified application.

In the Specification:

Please add the following paragraph after the title on page 1:

--This application is the national phase under 35 U.S.C. § 371 of PCT International Application No. PCT/EP99/09173 which has an International filing date of November 23, 1999, which designated the United States of America and was published in English.

In the Claims:

Please amend the claims as follows:

5. (Amended) An ultraviolet light source according to claim 2 having a dominant wavelength of 254nm.

6. (Amended) An ultraviolet light source according to claim 1, wherein the waveguide controls the flow of microwave energy from the enclosure.

7. (Amended) An ultraviolet light source according to claim 1, wherein the waveguide blocks the flow of microwave energy from the enclosure.

8. (Amended) An ultraviolet light source according to claim 1, wherein the enclosure comprises quartz or a UV-transparent plastic material.

9. (Amended) An ultraviolet light source according to claim 1, wherein the waveguide comprises a conducting material.

12. (Amended) An ultraviolet light source according to claim 1, wherein the ultraviolet lamp has an elongate form.

13. (Amended) An ultraviolet light source according to claim 1, wherein the transparent waveguide has a cylindrical or rectangular form.

14. (Amended) An ultraviolet light source according to claim 1, wherein the ultraviolet lamp has an operating temperature of less than 70°C.

15. (Amended) An ultraviolet light source according to claim 1, wherein the microwave energy source comprises a magnetron.

16. (Amended) An ultraviolet light source according to claim 1, additionally comprising a pathguide to guide the microwave energy from the microwave energy source to the ultraviolet lamp.

19. (Amended) An ultraviolet light source according to claim 1 additionally comprising a housing for said enclosure.

22. (Amended) An ultraviolet light source according to claim 20, additionally comprising a pump for pumping fluid from the inlet, past the enclosure to the outlet.

24. (Amended) Use of an ultraviolet light source according to claim 1 for sterilising a substance.

26. (Amended) Use of an ultraviolet light source according to claim 1 for curing glues and inks.

27. (Amended) Use of an ultraviolet light source according to claim 1 for erasing eproms.

28. (Amended) Use of an ultraviolet light source according to claim 1 for killing bacteria on the surface of goods.

29. (Amended) Air conditioning system comprising an ultraviolet light source according to claim 1.

30. (Amended) High intensity lighting system comprising an ultraviolet light source according to claim 1.

REMARKS

Claims 1-36 are pending in the present application.

The specification has been amended to provide a cross-reference to the previously filed International Application, and claims 5-9, 12-16, 19, 22, 24, and 26-30 have been amended to remove improper multiple dependencies.

Entry of the above amendments is earnestly solicited. An early and favorable first action on the merits is earnestly solicited.

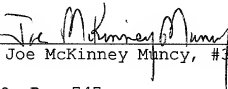
In the event that there are any outstanding matters remaining in this application, the Examiner is invited to contact the undersigned at (703) 205-8000 in the Washington, D.C. area.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By

  
Joe McKinney Muncy, #32,334

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(703) 205-8000

KM/asc  
3552-0107P  
Attachments

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

A paragraph has been added after the title on page 1.

In the Claims:

The claims have been amended as follows:

5. An ultraviolet light source according to [any of claims 2 to 4] claim 2 having a dominant wavelength of 254nm.

6. An ultraviolet light source according to [any of claims 1 to 5] claim 1, wherein the waveguide controls the flow of microwave energy from the enclosure.

7. An ultraviolet light source according to [either of claims 1 to 5] claim 1, wherein the waveguide blocks the flow of microwave energy from the enclosure.

8. An ultraviolet light source according to [any of claims 1 to 7] claim 1, wherein the enclosure comprises quartz or a UV-transparent plastic material.



9. An ultraviolet light source according to [any of claims 1 to 8] claim 1, wherein the waveguide comprises a conducting material.

12. An ultraviolet light source according to [any of claims 1 to 11] claim 1, wherein the ultraviolet lamp has an elongate form.

13. An ultraviolet light source according to [any of claims 1 to 12] claim 1, wherein the transparent waveguide has a cylindrical or rectangular form.

14. An ultraviolet light source according to [any of claims 1 to 13] claim 1, wherein the ultraviolet lamp has an operating temperature of less than 70°C.

15. An ultraviolet light source according to [any of claims 1 to 14] claim 1, wherein the microwave energy source comprises a magnetron.

16. An ultraviolet light source according to [any of claims 1 to 15] claim 1, additionally comprising a pathguide to guide the microwave energy from the microwave energy source to the ultraviolet lamp.

19. An ultraviolet light source according to [any of claims 1 to 18] claim 1 additionally comprising a housing for said enclosure.

22. An ultraviolet light source according to [either of claims 20 or 21] claim 20, additionally comprising a pump for pumping fluid from the inlet, past the enclosure to the outlet.

24. Use of an ultraviolet light source according to [any of claims 1 to 23] claim 1 for sterilising a substance.

26. Use of an ultraviolet light source according to [any of claims 1 to 23] claim 1 for curing glues and inks.

27. Use of an ultraviolet light source according to [any of claims 1 to 23] claim 1 for erasing eproms.

28. Use of an ultraviolet light source according to [any of claims 1 to 23] claim 1 for killing bacteria on the surface of goods.

29. Air conditioning system comprising an ultraviolet light source according to [any of claims 1 to 23] claim 1.

30. High intensity lighting system comprising an ultraviolet light source according to [any of claims 1 to 23] claim 1.

09/831449

4/PRTS

JC08 Rec'd PCT/PTO 10 MAY 2001

SteriliserTechnical Field

The present invention is in the field of sterilisation apparatus for sanitising or disinfecting a substance.

Background to the Invention

It is known to use ultraviolet (UV) radiation in sterilisation systems for use in the purification of water and the sanitisation of items. The UV radiation and any ozone produced by the UV radiation with oxygen in the air acts to kill bacteria and germs. It is also known to employ microwave energy to excite the source of UV radiation in such systems.

One problem with known systems is that it is difficult to safely provide sufficient excitation energy to the UV source and difficult to effectively transfer that energy to the substance to be sterilised. It is therefore difficult to arrange systems for high energy, high throughput sterilisation purposes.

There is now described a steriliser which enables efficient, high throughput sterilisation to be conducted. The steriliser comprises a UV lamp which is excited by a microwave energy source. The lamp is enclosed by a waveguide comprising UV transparent material.

WO96/40298 describes an electrodeless sterilisation apparatus comprising a UV lamp which is excited by a microwave energy source. The UV lamp is shaped to define a sterilisation passage therein. In use, the substance to be sterilised is passed through the sterilisation passage in the lamp. It may be appreciated that the size and geometry of the sterilisation passage will inevitably place limitations on the types of substances which may be sterilised using this apparatus and on the throughput achievable. It is also believed that direct contact of water with the lamp may affect the sterilisation capability of the lamp. Further, from a safety standpoint it is clearly undesirable that any breakage of the lamp may result in toxic vapour elements (e.g. mercury) contacting the substance to be sterilised.

US-A-5,166,528 describes a microwave excited ultraviolet steriliser for surface sterilisation of articles such as baby bottles and contact lenses. The steriliser comprises a plurality of UV bulbs which directly emit radiation to the articles.

US-A-5,141,636 describes a water purification system in which water is flowed along a flow path past a UV source. No mention is made of microwave excitation of the UV source.

WO97/35624 describes a steriliser employing a microwave-actuated UV energy source as the sterilisation means. No waveguide is provided between the UV energy source and the substance to be sterilised.

### Summary of the Invention

According to one aspect of the present invention there is provided a steriliser comprising an ultraviolet lamp; a microwave energy source for exciting said ultraviolet lamp; and an enclosure for enclosing the ultraviolet lamp, the enclosure comprising a UV transparent waveguide.

By steriliser it is meant an apparatus suitable for use in any sterilisation, sanitisation, purification or disinfection processes.

By UV transparent waveguide it is meant a waveguide that is substantially transparent to ultraviolet radiation, typically having a transparency of greater than 90%, preferably greater than 95% to UV radiation.

Suitably, the ultraviolet lamp has no electrode. That is to say it is an electrode-less lamp such as one comprising a partially evacuated tube comprising an element or mixtures of elements in vapour form. Mercury is a preferred element for this purpose, but alternatives include mixtures of inert gases with mercury compounds, sodium and sulphur. Preferably, the dominant wavelength produced by the lamp is 254nm.

In one aspect, the waveguide controls the flow of microwave energy from the enclosure. Control of the microwave energy which passes through the waveguide is useful in embodiments of the invention which make of both UV and microwave radiation in the sterilisation process.

In another aspect, the waveguide blocks the flow of microwave energy from the enclosure.

Suitably, the enclosure comprises quartz or a UV-transparent plastic material.

Suitably, the waveguide comprises a conducting material. The conducting material may be integral, or applied as a coating or liner. The liner may directly contact the inner surface of the enclosure or be spaced therefrom.

Suitably, the waveguide comprises a conducting mesh. Preferably, the conducting mesh comprises a material selected from the group consisting of copper, aluminium and stainless steel.

Suitably, the ultraviolet lamp has an elongate form such as a cigar-shape.

Suitably, the transparent waveguide has a cylindrical or rectangular form.

Suitably, the ultraviolet lamp has an operating temperature of less than 70°C.

Suitably, the microwave energy source comprises a magnetron. Alternative sources are envisaged such as solid state devices.

Suitably, the steriliser additionally comprises a pathguide to guide the microwave energy from the microwave energy source to the ultraviolet lamp.

In one aspect the pathguide defines an essentially linear path for the microwave energy.

In another aspect, the pathguide defines a non-linear path such as a path defining at least one right angle.

Suitably, the steriliser additionally comprises a housing for said enclosure. Preferably, the housing has an inlet and an outlet and the housing is shaped to guide fluid flow from the inlet, past the enclosure to the outlet. Preferably, the fluid comprises water or air. Suitably, the steriliser additionally comprises a pump for pumping fluid from the inlet, past the enclosure to the outlet. Alternatively, gravity may be utilised to encourage fluid flow.

According to another aspect of the present invention there is provided a lamp arrangement for use in a steriliser comprising an ultraviolet lamp, said lamp being excitable by microwave energy; and an enclosure for enclosing the ultraviolet lamp, the enclosure comprising a UV transparent waveguide.

Preferably, the ultraviolet lamp has no electrode.

According to a further aspect of the present invention there is provided a method of sterilising a substance comprising applying microwave energy to an ultraviolet lamp to produce ultraviolet radiation; and exposing the substance to said ultraviolet radiation, wherein an enclosure encloses the ultraviolet lamp, the enclosure comprising a UV transparent waveguide.

In one aspect, the substance flows past the enclosure.

#### Brief description of the drawings

Preferred embodiments of the steriliser in accord with the present invention will now be described with reference to the accompanying drawings in which:

Figure 1. is a schematic representation of a first steriliser herein suitable for water purification purposes;

Figures 2a and 2b are schematic representations of second and third sterilisers herein suitable for use in water purification;

Figures 3a and 3b are schematic representations of fourth and fifth sterilisers herein suitable for use in air purification;

Figure 4. is a schematic representation of a sixth steriliser herein suitable for use in combined UV and microwave sterilisation methods.

#### Detailed description of the invention

The present invention is here described by means of examples, which constitute possible embodiments of the invention.

Figure 1. shows a steriliser comprising an ultraviolet lamp 10 enclosed by cylindrical enclosure 20. The cylindrical walls of the enclosure 20 form a waveguide and are comprised of quartz material which is transparent to UV radiation. A conducting copper mesh 30 is provided to the inner surface of the waveguide. First end of the cylindrical enclosure has blocking end flange 22 provided thereto. The second end is provided with coupling flange 24 which couples with right angled waveguide 40 which in turn connects with rectangular waveguide 50. Magnetron 60 acts as a microwave energy source to feed microwaves into the rectangular waveguide 50, thence into the right angled waveguide 40 and finally to the ultraviolet lamp 10 which is excited thereby.

The enclosure 20 is within tubular housing 70. The housing 70 has a water inlet 72 and a water outlet 74 provided thereto. In use, water flows from the inlet 72 past the enclosure 20 and towards the outlet 74. As the water flows past the enclosure 20 it is irradiated with UV radiation produced by the ultraviolet lamp 10. The radiation itself passes through the UV transparent walls of the enclosure 120a, 120b to contact the water.

Figures 2a and 2b show related sanitisers herein. Both comprise ultraviolet mercury discharge lamp 110a, 110b enclosed by cylindrical enclosure 120a, 120b. The cylindrical walls of the enclosure 120a, 120b form a waveguide and are comprised of quartz material which is transparent to UV radiation. A conducting copper mesh 130a, 130b is provided to the inner surface of the waveguide. The enclosure 120a, 120b has air or nitrogen circulating therein. First end of the cylindrical enclosure has blocking end flange 122a, 122b provided thereto. The second end is provided with coupling flange 124a, 124b which couples with water-tight chamber 150a, 150b which contains brass waveguide 140a, 140b and magnetron 160a, 160b. The magnetron 160a, 160b acts as a microwave energy source to feed microwaves into the brass waveguide 140a, 140b and thence to the ultraviolet lamp 110a, 110b which is excited thereby.

The enclosure 120a, 120b is within tubular housing 170a, 170b. The housing 170a, 170b has a water inlet 172a, 172b and a water outlet 174a, 174b provided thereto. In use, water flows from the inlet 172a, 172b past the enclosure 120a, 120b and towards the outlet 174a, 174b. As the water flows past the enclosure 120a, 120b it is irradiated with UV radiation produced by the ultraviolet lamp 110a, 110b. The radiation itself passes through the UV transparent walls of the enclosure 120a, 120b to contact the water.

Figures 3a and 3b show sanitisers similar in structure to the sanitisers of Figures 2a and 2b but for use in air purification. Both comprise ultraviolet mercury discharge lamp 210a, 210b enclosed by cylindrical enclosure 220a, 220b. The cylindrical walls of the enclosure 220a, 220b form a waveguide and are comprised of quartz material which is transparent to UV radiation. A conducting copper mesh 230a, 230b is provided to the inner surface of the waveguide. The enclosure 220a, 220b has air or nitrogen circulating therein. First end of the cylindrical enclosure has blocking end flange 222a, 222b provided thereto. The second end is provided with coupling flange 224a, 224b which couples with airtight chamber 250a, 250b containing brass waveguide 240a, 240b and magnetron 260a, 260b. The magnetron 260a, 260b acts as a microwave energy source to feed microwaves into brass waveguide 240a, 240b and thence to the ultraviolet lamp 210a, 210b which is excited thereby.

The enclosure 220a, 220b is within tubular housing 270a, 270b. The housing 270a, 270b has an air inlet 272a, 272b and an air outlet 274a, 274b provided thereto. In use, air flows from the inlet 272a, 272b past the enclosure 220a, 220b and towards the outlet 274a, 274b. As the air flows past the enclosure 220a, 220b it is irradiated with UV radiation produced by the ultraviolet lamp 210a, 210b. The radiation itself passes through the UV transparent walls of the enclosure 220a, 220b to contact the air killing the bacteria and germs therein.

Figure 4 shows a cabinet steriliser herein suitable for use in sterilising objects such as medical instruments. Ultraviolet mercury discharge lamp 310 is enclosed by cylindrical enclosure 320. The cylindrical walls of the enclosure 320 form a waveguide and are comprised of quartz material which is transparent to UV radiation but only partially transparent to microwave radiation. A conducting copper mesh 330 is provided to the inner surface of the waveguide. The enclosure 320 optionally has air or nitrogen circulating therein. First end of the cylindrical enclosure has blocking end flange 322 provided thereto. The second end is provided with coupling flange 324 which couples with linear pathguide 340 which in turn connects with magnetron 360. The magnetron 360 acts as a microwave energy source to feed microwaves into pathguide 340 and thence to the ultraviolet lamp 310 which is excited thereby.

The enclosure 320 is within housing 370 which has an entry door 380 provided thereto. In use, items to be sterilised, which can include metal items, are placed in the housing 370. The items are irradiated with UV radiation produced by the ultraviolet lamp 310 and by microwave radiation deriving from the magnetron



360. The radiation itself, passes through the UV transparent and microwave partially transparent walls of the enclosure 320 to contact the items. Optionally, the housing 370 may be provided with UV transparent shelves for the items. An inner reflective lining, for example an aluminium foil lining, may also be provided to the housing 370.

The steriliser of the present invention is suitable for use in sterilising water for human consumption; sterilising waste water and sewage; sterilising metallic and non-metallic objects including medical instruments; sterilising air in buildings such as hospitals, offices and homes; curing glues and special inks; erasing eproms; and prolonging the shelf-life of foodstuffs by killing bacteria on the surface of the goods.

The steriliser of the present invention is suitable in one aspect for use in air-conditioning systems for use in vehicles such as cars, lorries and buses. The sanitiser will be sized and shaped to fit within the air-conditioning system of the vehicle and will typically therefore have a size less than the size it would possess when used in large scale air and water treatment applications.

The ultraviolet light produced by the sanitiser herein may additionally be channelled as a light source of high intensity. Suitable uses would include lighting within buildings and lighting for vehicles such as cars, lorries and buses.

P0004 – Art 19 amended claims NEW

Claims

1. An ultraviolet light source comprising  
an ultraviolet lamp;  
a microwave energy source for exciting said ultraviolet lamp; and  
a waveguide for guiding microwave energy originating from said microwave energy source to the ultraviolet lamp, wherein said waveguide is UV transparent and wholly surrounds the ultraviolet lamp.
2. An ultraviolet light source according to claim 1, wherein the ultraviolet lamp has no electrode.
3. An ultraviolet light source according to claim 2, comprising an element or mixture of elements in vapour form.
4. An ultraviolet light source according to claim 3, wherein said element or mixture of elements comprises mercury, sodium, sulphur or mixtures of inert gases with mercury compounds.
5. An ultraviolet light source according to any of claims 2 to 4 having a dominant wavelength of 254nm.
6. An ultraviolet light source according to any of claims 1 to 5, wherein the waveguide controls the flow of microwave energy from the enclosure.
7. An ultraviolet light source according to either of claims 1 to 5, wherein the waveguide blocks the flow of microwave energy from the enclosure.
8. An ultraviolet light source according to any of claims 1 to 7, wherein the enclosure comprises quartz or a UV-transparent plastic material.
9. An ultraviolet light source according to any of claims 1 to 8, wherein the waveguide comprises a conducting material.
10. An ultraviolet light source according to claim 9, wherein the waveguide comprises a conducting mesh.
11. An ultraviolet light source according to claim 10, wherein the conducting mesh comprises a material selected from the group consisting of copper, aluminium and stainless steel.
12. An ultraviolet light source according to any of claims 1 to 11, wherein the ultraviolet lamp has an elongate form.
13. An ultraviolet light source according to any of claims 1 to 12, wherein the transparent waveguide has a cylindrical or rectangular form.

P0004 - Art 19 amended claims

14. An ultraviolet light source according to any of claims 1 to 13, wherein the ultraviolet lamp has an operating temperature of less than 70°C.
15. An ultraviolet light source according to any of claims 1 to 14, wherein the microwave energy source comprises a magnetron.
16. An ultraviolet light source according to any of claims 1 to 15, additionally comprising a pathguide to guide the microwave energy from the microwave energy source to the ultraviolet lamp.
17. An ultraviolet light source according to claim 16, wherein the pathguide defines an essentially linear path.
18. An ultraviolet light source according to claim 16, wherein the pathguide defines a non-linear path.
19. An ultraviolet light source according to any of claims 1 to 18 additionally comprising a housing for said enclosure.
20. An ultraviolet light source according to claim 19, wherein the housing has an inlet and an outlet and the housing is shaped to guide fluid flow from the inlet, past the enclosure to the outlet.
21. An ultraviolet light source according to claim 20, wherein said fluid comprises water or air.
22. An ultraviolet light source according to either of claims 20 or 21, additionally comprising a pump for pumping fluid from the inlet, past the enclosure to the outlet.
23. An ultraviolet light source substantially as described in the accompanying description and drawings
24. Use of an ultraviolet light source according to any of claims 1 to 23 for sterilising a substance.
25. Use according to claim 24, wherein said substance is selected from the group consisting of water for human consumption; waste water; sewage; metallic and non-metallic objects; and air.
26. Use of an ultraviolet light source according to any of claims 1 to 23 for curing glues and inks.
27. Use of an ultraviolet light source according to any of claims 1 to 23 for erasing eprints.
28. Use of an ultraviolet light source according to any of claims 1 to 23 for killing bacteria on the surface of goods.

## P0004 - Art 19 amended claims NEW

29. Air conditioning system comprising an ultraviolet light source according to any of claims 1 to 23.

30. High intensity lighting system comprising an ultraviolet light source according to any of claims 1 to 23.

31. A lamp arrangement comprising

an ultraviolet lamp, said lamp being excitable by microwave energy; and

a waveguide for guiding microwave energy originating from a microwave energy source to the ultraviolet lamp,

wherein said waveguide is UV transparent and wholly surrounds the ultraviolet lamp.

32. A lamp arrangement according to claim 31, wherein the ultraviolet lamp has no electrode.

33. A lamp arrangement substantially as described in the accompanying description and drawings

34. A method of sterilising a substance comprising

guiding microwave energy from a microwave energy source to an ultraviolet lamp to produce ultraviolet radiation; and

exposing the substance to said ultraviolet radiation, wherein

a waveguide guides said microwave energy to said ultraviolet lamp and said waveguide is UV transparent and wholly surrounds the ultraviolet lamp.

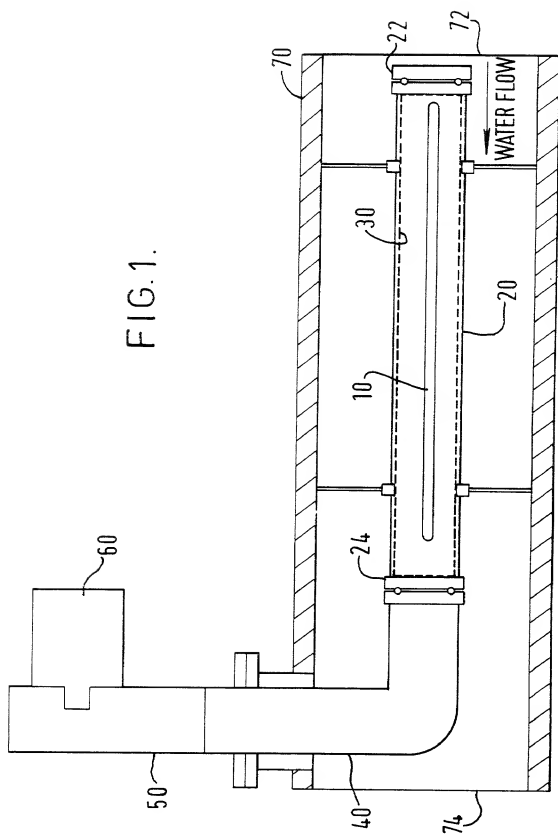
35. A method according to claim 34, wherein the substance flows past said enclosure.

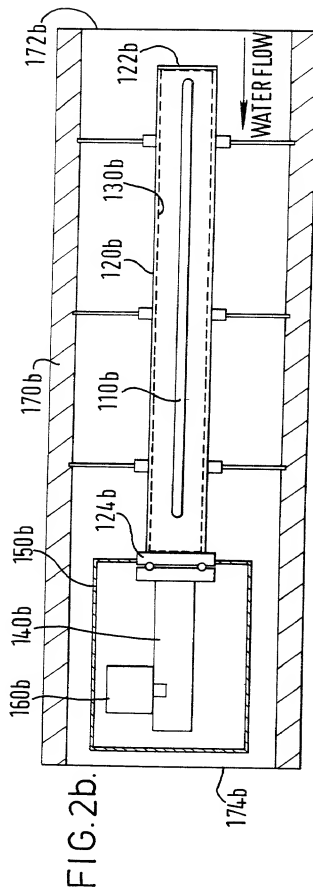
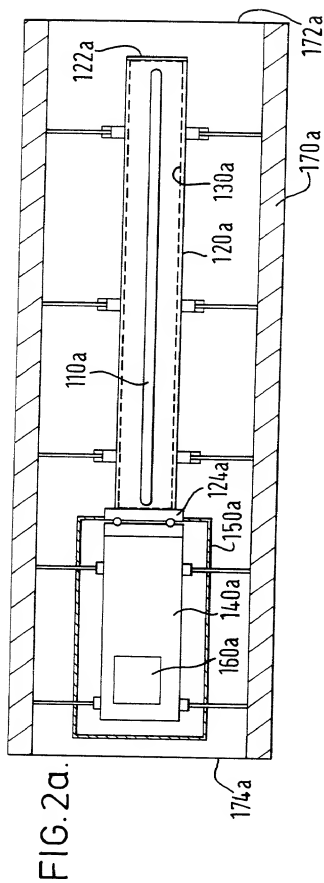
36. A method of sterilising a substance substantially as described in the accompanying description and drawings.

Abstract

There is described a steriliser comprising an ultraviolet lamp, a microwave energy source for exciting said ultraviolet lamp and an enclosure for enclosing the ultraviolet lamp, the enclosure comprising a UV transparent waveguide. The steriliser is particularly suitable for use in the purification of water.

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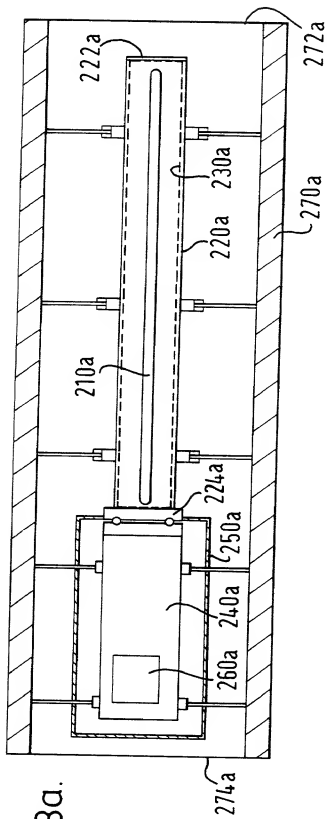


FIG. 3a.

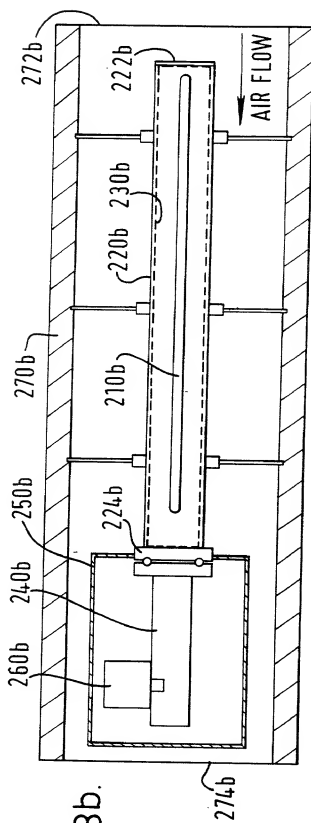
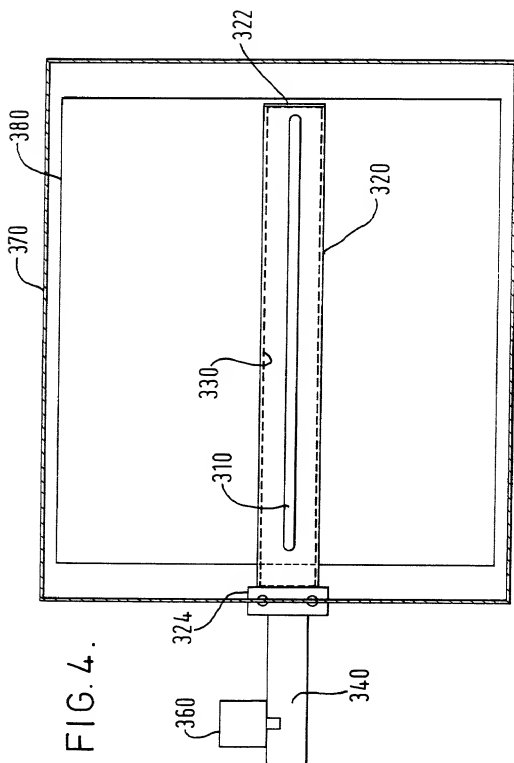


FIG. 3b.





I hereby appoint the following attorneys to prosecute this application and/or an international application based on this application and to transact all business in the Patent and Trademark Office connected therewith and in connection with the resulting patent based on instructions received from the entity who first sent the application papers to the attorneys identified below, unless the inventor(s) or assignee provides said attorneys with a written notice to the contrary:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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# COMBINED DECLARATION AND POWER OF ATTORNEY FOR PATENT AND DESIGN APPLICATIONS

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated next to my name; that I verily believe that I am the original, first and sole inventor (if only one inventor is named below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Insert Title:

STERILISER

Fill in Appropriate  
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 Specification  
 Attached:

the specification of which is attached hereto. If not attached hereto,  
 the specification was filed on May 10, 2001 as  
 United States Application Number 09/831,449 \_\_\_\_\_ as  
 and amended on \_\_\_\_\_ (if applicable) and/or  
 the specification was filed on November 23, 1999 \_\_\_\_\_ as PCT  
 International Application Number PCT/EP99/09173 \_\_\_\_\_; and was  
 amended under PCT Article 34 on December 18, 2000 \_\_\_\_\_ (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I do not know and do not believe the same was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representative or assigns more than twelve months (six months for designs) prior to this application, and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by me or my legal representatives or assigns, except as follows.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Insert Foreign  
 Information:  
 (if appropriate)

Prior Foreign Application(s)		Priority Claimed
<u>9826033.4</u> (Number)	<u>Great Britain</u> (Country)	<u>November 28, 1998</u> (Month/Day/Year Filed)
		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<u>9917661.2</u> (Number)	<u>Great Britain</u> (Country)	<u>July 29, 1999</u> (Month/Day/Year Filed)
		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<u>                    </u> (Number)	<u>                    </u> (Country)	<u>                    </u> (Month/Day/Year Filed)
		<input type="checkbox"/> Yes <input type="checkbox"/> No
<u>                    </u> (Number)	<u>                    </u> (Country)	<u>                    </u> (Month/Day/Year Filed)
		<input type="checkbox"/> Yes <input type="checkbox"/> No

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below.

Insert Provisional  
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 (if any)

<u>                    </u> (Application Number)	<u>                    </u> (Filing Date)
<u>                    </u> (Application Number)	<u>                    </u> (Filing Date)

All Foreign Applications, if any, for any Patent or Inventor's Certificate Filed More than 12 Months (6 Months for Designs) Prior to the Filing Date of This Application:

Country	Application Number	Date of Filing (Month/Day/Year)
<u>                    </u>	<u>                    </u>	<u>                    </u>
<u>                    </u>	<u>                    </u>	<u>                    </u>

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 (if appropriate)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States and/or PCT application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States and/or PCT application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to the patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

Insert Prior U.S.  
 Application(s):  
 (if any)

<u>                    </u> (Application Number)	<u>                    </u> (Filing Date)	<u>                    </u> (Status - patented, pending, abandoned)
<u>                    </u> (Application Number)	<u>                    </u> (Filing Date)	<u>                    </u> (Status - patented, pending, abandoned)